In section four, Of lecture four, we're going to divide this into two parts. We will be looking at the overall
structure of the heavy chains. In the first unit on this, we'll look
at some general considerations for how this heavy chain is constructed. Now I've certainly shown
you an antibody before, and this is one of the sort of commercial
pictures that's kind of cool. And this has a very particular
kind of category of structure, one with a flexible hinge region. So here's the flexible hinge region,
here are the two complementary determining regions, that is the arms of the y where the antigen will attach. And there is the stem or FC region,
which will essentially be the yoo-hoo region that will
summon other immune functions. We can also see this on the foam
board diagram that I have drawn. And so here is the heavy
chain running down this way. And you can see that this heavy
chain has a variable domain. And it has several constant domains. And this one also has the flexible hinge. And you can see the carbohydrate attached. However, this is not the only kind of
heavy chain that you have in antibodies. And in the different
classes of antibodies, we're going to have different
kinds of heavy chains. I've summarized that for
you in this table, and you have this table in your outline,
this has a lot of detail on it. And in the second part
of Roman numeral four, in other words, part six,
we're going to go into this and look at some of the specific
properties of the classes. But right now, what we're going into
is a sort of fundamental orientation of the two sort of general types of classes and ways of constructing an antibody. And here they are,
the one that we've been looking at so far is the one here on the left
with the flexible hinge region. If you look at the one on the right,
it turns out it has a rigid bend. And one of the differences that
produces this is, of course, you don't have the hingy
structure on the right. But rather, as it turns out,
an additional constant domain. So let's go travel down this heavy chain,
and just kind of take a look at everything else that
we can have in here. Okay so we're going to start up
here on the variable region, and I'm pointing again
to the variable regions. And you can see, these are the ones
we formed during gene rearrangement. And we'll look at that process
in detail in the next lecture. The next domain is C1,
the first constant domain, and we've got that in both types. In the next region, we have either the flexible hinge, or another constant domain. Now, what's going on here,
all of these domains that we have that are lumps are ways
of representing that bread and butter sandwich that we showed in
detail in the foam board model, so this is yet another shorthand. In this hinge region,
we are going to have a shorthand for what turns out to be a string of
prolenes that are stabilized by, typically two, but
it could be even more, we'll see, or less, of these disulfide bonds
that help to hold it together. And then the FC stem region in both cases will be made up of two
immunoglobulin domains. And so
when we're going to go look at this thing, if we travel up here in the heavy region. If you, well,
let me go back to my foam board model. So let's take again
a closer look up in here, and you can see that this is
where the variable region is. And it has all these different colors, because we'll see that when we put
together from different domains. But notice that this variable domain
still has an immunoglobulin domain with the beta pleated sheets. That holds, as it turns out,
those three loops so that they're sticking out and will
participate in recognizing the antigen. That then actually constitutes

the hypervariable region, because it turns out that while I call
this whole thing a variable domain, only the little loopy things
at at the tips of this are the ones that actually
vary a great deal. They're called hypervariable,
and actually, the other part, because it really forms the framework for
sticking them out, actually doesn't vary a whole lot. It's got a specific
general function,
you can't screw with it. All right, so we're going to go from the end terminal
of this domain to the C terminal. And that will lead into
the first constant domain. So let's look then,
here is a hinge region on this one, and let's go back to our comparison and
compare this with the rigid band. Okay, so here they are,
laid out side by side. And we've got the next region
that we're going into, okay. First the variable,
then the first constant domain, and then the hinge bend [LAUGH]. And you have a
hinge in G class and A class and, as it turns out,
D class antibodies. But we have an extra constant
region in both the M class, which is the first antibody you make,
and the E class, which is the antibody that's
involved in allergies. So that we call the M class,
and it has a mu chain. The G class has a gamma chain,
the A class has an alpha, the D class has delta, and
the E class has an epsilon. You're simply switching from Roman
to Greek as you describe either the overall class or the specific
heavy chain that determines that. Now, a little bit of a reminder here, any
of these classes can have any of the light chains, the light chains can
be either kappa or lambda. And that has absolutely nothing
to do with what class you have. The class of an antibody
is solely determined by which type of heavy chain it has. So continuing on down,
the next constant domain in here is called, again, C2 in the bendy ones, and
C3 in the rigid ones. And the last one at what would
be the C terminal is, again, C3 for the bendy ones,
and C4 for the rigid ones. The carbohydrate is attached in here so that it tends
to open up and
spread out the two C terminal ends. The C terminal ends on those
two domains will have different specificities to their structure. And again,
that's going to determine
the different specificities of the action. So I kind of divide these in top and
bottom, and the top half is involved
in recognizing antigen, and the bottom half is something that
I would call the yoo-hoo part. And that's going to be
the last two domains, whether that is C2 and 3,
or in this case C3 and 4. So again, if we have a membrane-bound
version of these things, we will have a membrane spanning region
that is attached to the C terminal. And we will see that in memory
cells in all five classes, and we will see that in naive B cells,
in the M and D. And those processes, we'll look at later,
but right now, take a good look. There's basically two
categories of antibodies with the flexible hinge,
with the rigid bend. The ones with a rigid bend
have an extra constant domain. And we're about to go
through them one by one and talk about their specific properties.